22096014

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

BIOLOGY
HIGHER LEVEL
PAPER 2

Wednesday 6 May 2009 (afternoon)

2 hours 15 minutes

Candidate session number

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INSTRUCTIONS TO CANDIDATES

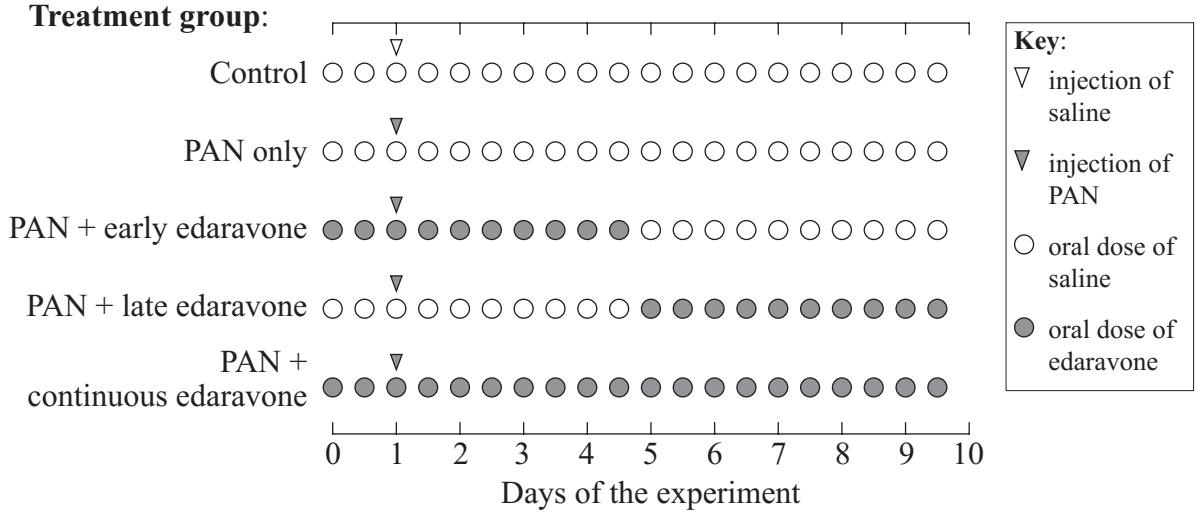
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer two questions from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

22096014

SECTION A

*Answer **all** the questions in the spaces provided.*

1. Medical scientists investigated the development of nephrotic syndrome, a kidney disease that results in the abnormal presence of protein in the urine. This symptom of the disease can also be caused by injecting puromycin aminonucleoside (PAN) into rats. The drug edaravone, a proposed treatment for the disease, was studied. The experimental timetable for the different treatment groups is summarized below. Edaravone was given by mouth (oral dose). Saline is a solution with the same concentration of solutes as blood plasma.



[Source: H. Matsumura, A. Ashida, K. Hirano, H. Nakakura and H. Tamai, "Protective effect of radical scavenger edaravone against puromycin nephrosis", *Clinical Nephrology*, Vol. 66, no. 6/2006, pp. 405-410. Reprinted with permission.]

(a) State when PAN was injected into the rats. *[1]*

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(b) Outline the treatment given to the control group. *[2]*

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(c) Distinguish between the treatment received by the PAN only group and the PAN + early edaravone group. *[1]*

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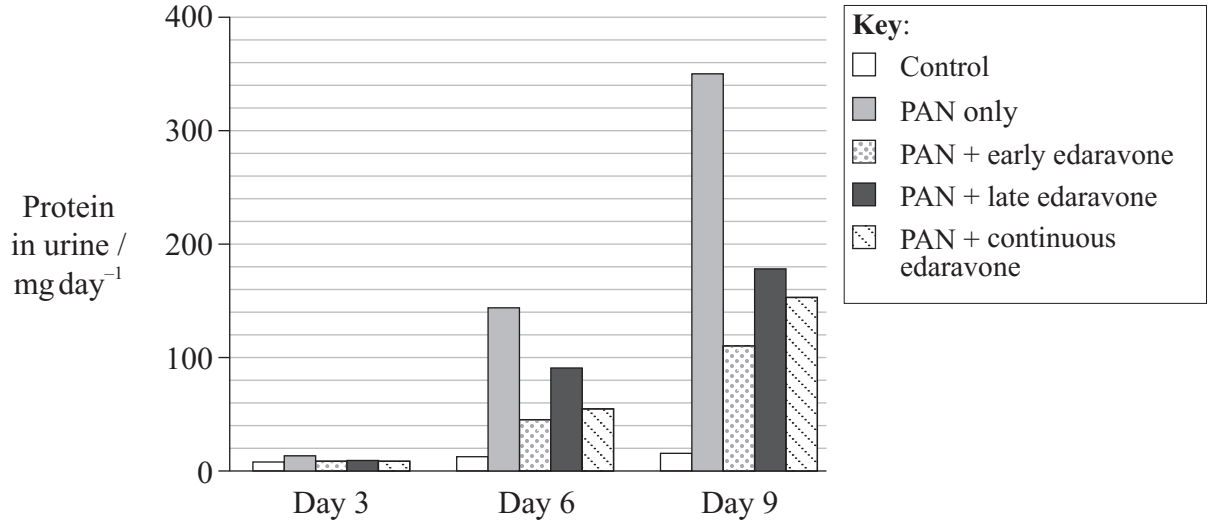
(Question 1 continued)

The graph below shows the levels of protein found in the urine of the rats on day 3, day 6 and day 9 of the experiment.



[Source: H. Matsumura, A. Ashida, K. Hirano, H. Nakakura and H. Tamai, "Protective effect of radical scavenger edaravone against puromycin nephrosis", *Clinical Nephrology*, Vol. 66, no. 6/2006, pp. 405-410. Reprinted with permission.]

(d) State the increase in protein in the urine of rats treated with PAN only between day 6 and day 9. *[1]*

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(e) Compare the levels of protein during the experiment in the urine of rats treated using PAN only with those treated using PAN + early edaravone. *[3]*

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(f) Evaluate whether the results support the hypothesis that a continuous dose of edaravone is better than the same drug administered over shorter periods. *[3]*

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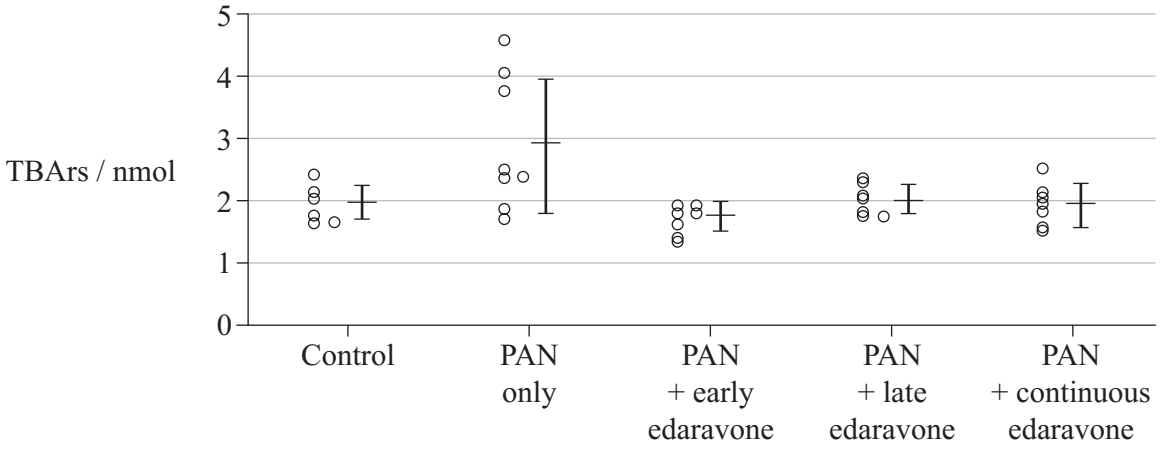
(Question 1 continued)

Oxidation reactions can cause damage to cells. Thiobarbituric acid reactive substances (TBArs) are produced when membrane lipids are damaged by oxidation. Experiments were carried out to investigate the effect of edaravone on the production of TBArs.



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(g) Analyse the results of this experiment. *[3]*

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(h) Suggest why oxidation of membrane lipids may lead to increased protein loss in the urine. *[3]*

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2. (a) Draw a labelled diagram showing **two** different complementary pairs of nucleotides in a molecule of DNA. *[4]*

(b) Outline the structure of nucleosomes. *[2]*

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(c) Explain primary structures and tertiary structures of an enzyme. *[3]*

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3. (a) Define the term *polygenic inheritance*. *[1]*

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(b) Explain, using a **named** example, how polygenic inheritance gives rise to continuous variation. *[2]*

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(c) Describe the inheritance of colour blindness in humans. *[3]*

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SECTION B

*Answer **two** questions. Up to two additional marks are available for the construction of your answers. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.*

4. (a) Draw a labelled diagram showing the tissues present in a dicotyledonous leaf. *[4]*

(b) Outline the light-dependent reactions of photosynthesis. *[6]*

(c) Explain the effect of light intensity and temperature on the rate of photosynthesis. *[8]*

5. (a) Draw a labelled diagram of the adult female reproductive system. *[4]*

(b) Outline the roles of progesterone and estrogen in the human menstrual cycle. *[6]*

(c) Explain the function and structure of the placenta. *[8]*

6. (a) Draw a labelled diagram showing the ultra-structure of a liver cell. *[4]*

(b) Distinguish between prokaryotic cells and eukaryotic cells. *[6]*

(c) Explain prokaryotic DNA replication. *[8]*

7. (a) Draw a labelled diagram of the heart showing the chambers, associated blood vessels and valves. *[4]*

(b) Describe the processes involved in blood clotting. *[6]*

(c) Discuss the benefits and risks associated with vaccination programmes. *[8]*